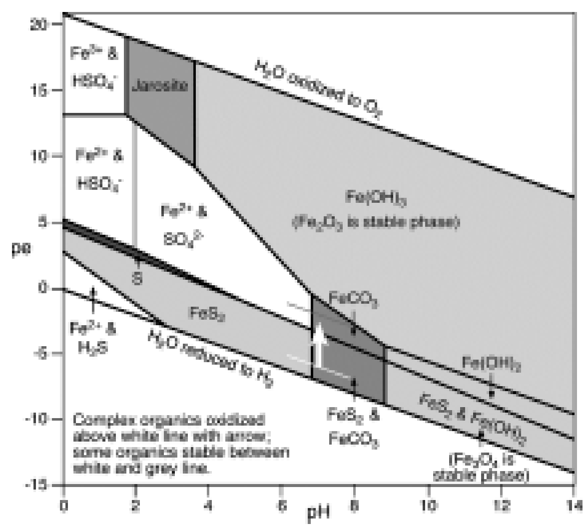
POOR PRESERVATION POTENTIAL OF ORGANICS IN MERIDIANI PLANUM UNIT P2 SEDIMENTARY ROCKS. Dawn Y. Sumner, Geology Department, University of California, Davis, CA 95616, sumner@geology.ucdavis.edu.

Issue. New data from MER rover Opportunity, which landed in Meridiani Planum P2 sedimentary rocks as mapped by Hynek et al. [2002], demonstrates substantial water flow and water-rock interactions in pre-3 Ga sediments containing substantial sulfate evaporites, jarosite, and hematite. These data have increased excitement over the exploration for an early Martian biosphere. However, this search needs to be carefully directed by the preservation potential of possible biosignatures, including organic compounds. The abundance of Fe(III) in unit P2 indicate that organic compounds have a poor preservation potential in these sedimentary rocks.



Fe-S-C Chemistry and Rocks. Organic compounds consist of variably reduced carbon, whereas hematite and sulfate minerals contain oxidized iron and sulfur. These 3 phases are not in thermodynamic equilibrium (figure) and are not expected to be present in the same rocks. The kinetics of sulfate reduction to sulfide are slow, however (e.g. billions of years at pH~>4; Ohmoto and Lasaga, 1982), so the preservation of organics in sulfate-rich sediments is kinetically reasonable. In contrast, Fe(III) reduction to Fe(II) is rapid and strongly coupled to oxidation of organics in water and sediments [e.g. Lovley et al., 1981], in part through the catalysis of oxygen-derived free radicals [e.g. Stumm and Morgan, 1996]. This reaction potential is commonly observed in rocks. Hematite-rich facies lack organics whereas siderite (Fe(II) carbonate) facies are commonly associated with preserved organic compounds [e.g. Kaufman et al., 1990]. Where organics are preserved in acid lake deposits, hematite has been reduced to soluble Fe(II) in “reduction spots” [e.g., Benison and Goldstein, 2001]. Organic inclusions within associated sulfates have not been reported. Similarly, iron-rich concretions only contain organic carbon when formed of pyrite (Fe(II) sulfide) or siderite; hematite concretions form around oxidized zones rather than reduced zones [e.g. Chan et al., 2000].

Implications for P2. Hematite concretions are excellent for indicating extended water-rock interaction, but complex organic compounds that would act as biomarkers are not likely to be preserved in sediments rich in Fe(III), even if they were abundant when the sediments were deposited. Identification of reduced iron minerals could indicate redox reactions consistent with organic decay (but not requiring organic decay). However, in the absence of strong evidence for specific conditions that would isolate organics and Fe(III) from each other in these rocks, *in situ* characterization of organic compounds in P2 rocks is unlikely to produce positive results.

Benison & Goldstein 2001, *Sediment, 48*, 165-188. Chan, Parry, & Bowman 2000, *Am. Assoc. Petrol. Geol. Bull., 84*,1281–1310. Kaufman, Hayes, & Klein 1990, *Geochim. Cosmochim. Acta, 54*, 3461-3473. Lovely, Phillips, & Lonergan 1991, *Environ. Sci. Tech., 25,* 1062-1067. Ohmoto & Lasaga 1982, *Geochim. Cosmochim. Acta, 46,* 1727-1745. Stumm & Morgan 1996, *Aquatic Chem.*, 1022 pp.